

**REMARKS**

The Applicants thank the Examiner for the thorough consideration given the present application. Claims 1-14, and 16-20 are pending. Claim 15 is canceled herein without prejudice to or disclaimer of the subject matter contained therein. Claims 1-11, 3, 14, 16, and 17 are amended, and claims 18-20 are added. Claims 1 and 18 are independent. The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein.

**Claim for Priority**

It is gratefully acknowledged that the Examiner has recognized the Applicants' claim for foreign priority. In view of the fact that the Applicants' claim for foreign priority has been perfected, no additional action is required from the Applicants at this time.

**Drawings**

The drawings are objected to FIGS. 4A, 4B, and 4C, because the reference labels are not identified in the specification. In response, the specification is amended to include each of the reference numerals shown in FIGS. 4A, 4B, and 4C.

In addition, one (1) sheet of revised formal drawings is being submitted to amend FIG. 2 to properly identify center C and internal area 53 of the resonator 50, and bottom portion 62 of the waveguide 60.

**Title**

The title is amended to read --LIGHTING APPARATUS USING MICROWAVES--.

**Specification Objection**

The Examiner has objected to the specification because of several informalities.

In order to overcome this objection, the specification is amended herein in order to correct the deficiencies pointed out by the Examiner. In addition, a Substitute Specification is being provided in order to place the application in better form. Also included is a marked-up copy of the original specification which shows the portions of the original specification which are being added and deleted. Applicants respectfully submit that the substitute specification includes no new matter and that the substitute specification includes the same changes as are indicated in the marked-up copy of the original specification showing additions and deletions. Reconsideration and withdrawal of this objection are respectfully requested.

**Abstract of the Disclosure**

The Abstract of the Disclosure is amended to correct minor informalities.

**Claim Objections**

The Examiner has objected to claims 1, 3-6, and 8-10 because of several informalities. In order to overcome this objection, claims 1, 3-6, and 8-10 are amended herein in order to correct the deficiencies pointed out by the Examiner. Reconsideration and withdrawal of this objection are respectfully requested.

**Rejection Under 35 U.S.C. § 112, second paragraph**

Claims 1-17 stand rejected under 35 U.S.C. § 112, second paragraph. This rejection is respectfully traversed.

The Examiner has set forth certain instances wherein the claim language is indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention.

In order to overcome this rejection, Applicants have amended claims 1-11, 13, 14, 16, and 17 to correct each of the deficiencies specifically pointed out by the Examiner. Applicants respectfully submit that the claims, as amended, particularly point out and distinctly claim the subject matter which Applicants regard as the invention. With regards to "bottom portion" recited in claims 5, 6, and 14, the Examiner will note that the specification and FIG 2. are each amended to show bottom portion 62.

Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

**Rejection Under 35 U.S.C. §102(b)**

Claims 1, 15, and 16 stand rejected under 35 U.S.C. §102(b) as being anticipated by Simpson (U.S. 5,525,865). This rejection is respectfully traversed.

While not conceding the appropriateness of the Examiner's rejection, but merely to advance prosecution of the instant application, independent claim 1 is amended herein recite a

combination of elements directed to a lighting apparatus using microwaves including a conical shaped waveguide transmitting the microwaves into the resonator.

In addition, independent claim 18 is added to recite a combination of elements directed to a lighting apparatus using microwaves including outwardly extended flange portions respectively provided on the resonator and the waveguide, the waveguide being placed in an internal domain of the resonator, and being fixed to the resonator by fixing means passing through the extended flange portions.

Full support for conical shaped waveguide 50 can be found in the specification, for example in paragraphs [0016] and [0031]. Full support for outwardly extended flange portions 61, 66 respectively provided on the resonator 50 and the waveguide 60, the waveguide 60 being placed in an internal domain of the resonator 50, and being fixed to the resonator by fixing means 90 passing through the extended flange portions 61, 66, can be found in paragraph [0029]. See also FIG. 2.

Applicants respectfully submit that the combinations of elements as set forth in independent claims 1 and 18 are not disclosed or made obvious by the prior art of record, including Simpson.

Applicants respectfully submit that Simpson fails to teach or suggest a conical shaped waveguide, as set forth in independent claim 1, and instead merely shows an inner conductor 23, which in FIGS. 4 and 5, appears to be linearly shaped.

Further there is no teaching or suggestion whatsoever of outwardly extended flange portions respectively provided on the resonator and the waveguide, the waveguide being placed in an internal domain of the resonator, and being fixed to the resonator by fixing means passing through the extended flange portions, as set forth in independent claim 18.

Applicants respectfully submit that the combinations of elements as set forth in independent claims 1 and 18 are not disclosed or made obvious by the prior art of record, including Simpson, for the reasons explained above.

Therefore, claims 1 and 18 and the claims depending therefrom are in condition for allowance. Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. §102(b) are respectfully requested.

### CONCLUSION

Since the remaining patents cited by the Examiner have not been utilized to reject claims, but merely to show the state of the art, no comment need be made with respect thereto.

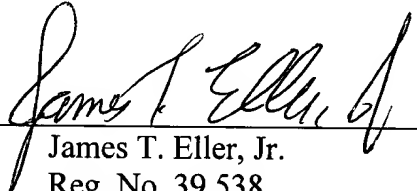
All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and that the present application is in condition for allowance.


If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone Carl T. Thomsen (Reg. No. 50,786) at (703) 205-8000.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly extension of time fees.

Respectfully submitted,

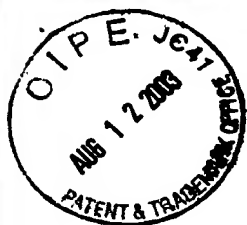
BIRCH, STEWART, KOLASCH & BIRCH, LLP

By   
James T. Eller, Jr.  
Reg. No. 39,538

0630-1349P  
JTE/CTT/mua  


P. O. Box 747  
Falls Church, VA 22040-0747  
(703) 205-8000

Attachments: Abstract of the Disclosure  
One (1) replacement drawing sheet  
Substitute Specification (both clean and marked-up copies)



## LIGHTING APPARATUS USING MICROWAVES

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The present invention relates to a lighting apparatus using microwave, and in particular to a lighting apparatus using microwaves which is capable of emitting lights by applying microwave to an electrodeless bulb.

#### 2. Description of the Conventional Art

**[0002]** A lighting apparatus using microwaves emits visible rays or ultraviolet rays by applying microwaves to an electrodeless bulb, it has longer life span and better lighting effectiveness than a general incandescent lamp or a fluorescent lamp.

**[0003]** Figure 1 is a longitudinal sectional view illustrating an internal structure of a lighting apparatus using microwaves.

**[0004]** A lighting apparatus using microwave includes a magnetron 1, a waveguide 3 transmitting microwaves from the magnetron 1 to a bulb 5, the bulb 5 emitting lights by ~~plasmating the plasma generated from the~~ enclosed materials by the microwave energy transmitted through the waveguide 3, and a resonator 10 placed in front of the waveguide 3 and the bulb 5, excluding the microwaves and transmitting the light emitted from the bulb 5.

**[0005]** Particularly, the resonator 10 has a cylindrical shape and has a metal mesh structure in order to exclude microwaves while transmitting the light emitted from the bulb 5.

**[0006]** The lighting apparatus using microwaves further includes a high voltage

generator 7 boosting the voltage of an alternating current and supplying it to the magnetron 1, a cooling unit 9 refrigerating the magnetron 1 and the high voltage generator 7, a reflector 11 intensively reflecting the light emitted from the bulb 5 ~~in the front~~, and a control unit (not shown) controlling various elements including the high voltage generator 7 and the cooling unit 9.

**[0007]** In the lighting apparatus using microwaves, when an operating signal is inputted from the control unit to the high voltage generator 7, the high voltage generator 7 boost the voltage of the AC power and supplies the boosted AC power to the magnetron 1.

**[0008]** The magnetron 1 oscillates by the high voltage supplied from the high voltage generator 7 and generates microwaves having a very high frequency, the generated microwaves ~~is~~ are emitted into the resonator 10 through the waveguide 3, materials enclosed inside the bulb 5 are discharged, accordingly light having an inherent emission spectrum is generated.

**[0009]** The light generated from the bulb 5 ~~reflects in the front through~~ this reflected by a mirror 12 and the reflector 11 and lights up a space.

**[0010]** However, in the lighting apparatus using microwaves in accordance with the ~~conventional~~ background art, because the resonator 10 is constructed with a cylindrical metal mesh, most of lights emitted from the bulb 5 transmit the metal mesh and are projected in the front, and part of the lights is reflected on the metal mesh and scattered all over the place inside the resonator 10, accordingly there is a limitation in maximizing a lighting efficiency.

**[0011]** In more detail, because the resonator 10 has the cylindrical shape, a focus of the light reflected onto the metal mesh is not fixed and the light is reflected intricately and scattered all over the place, accordingly the lighting efficiency is lowered due to the loss of the light.



**[0012]** In addition, because the resonator 10 is ~~lengthily projected~~projects lengthwise from the front of the waveguide 3, and a large size of the reflector 11 is installed ~~at the circumstances of~~required to surround the resonator 10, it is difficult to minimize the lighting system.

#### SUMMARY OF THE INVENTION

**[0013]** In order to solve above-mentioned problems, it is an object of the present invention to provide a lighting apparatus using microwaves which is capable of improving a lighting efficiency and miniaturizing a lighting system by minimizing a loss of light emitted from a bulb by installing a waveguide inside a resonator and installing a bulb at the center of the resonator.

**[0014]** In order to achieve the object of the present invention, a lighting apparatus using microwaves includes a resonator ~~excluding microwave and~~ transmitting a light but preventing the escape of microwaves, a waveguide placed at an internal domain of the resonator and transmitting the microwaves, a microwave generating means installed at the side of the resonator and ~~oscillating~~ transmitting microwaves into the waveguide, and a bulb placed at the center of the resonator and emitting light by generating a plasma by the microwaves transmitted through the waveguide.

**[0015]** Herein, the resonator has a ~~sphere~~spherical shape, and the waveguide is installed within ~~the radius~~a radial sector of the resonator.

**[0016]** The waveguide has a ~~conic~~conical shape, the vertex of the waveguide is placed at the center of the resonator, the cover portion of the waveguide is formed as a curved surface ~~so as to behaving a shape the same as the sphere~~spherical shape of the resonator and is placed so as to correspond to an external extended

portion of the resonator.

**[0017]** The lighting apparatus using microwaves having the micro—wave generating means further includes a high voltage generator and a casing covering a cooling unit, and the casing is combined and fixed to the cover portion of the waveguide at the external extended portion of the resonator.

**[0018]** The bulb is placed at the center of the resonator, and the microwave generating means is fixed to the waveguide at the external extended portion of the resonator.

**[0019]** Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0020]** The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

**[0021]** Figure 1 is a longitudinal sectional view illustrating a lighting apparatus using microwaves in accordance with the ~~conventional~~ background art;

**[0022]** Figure 2 is a longitudinal sectional view illustrating a lighting apparatus using microwaves in accordance with the present invention;

**[0023]** Figure 3 is a plan view illustrating the lighting apparatus of Figure 2 taken

along the line of A-A; and

**[0024]** Figures 4A, 4B, and 4C are plan views of other embodiments illustrating shapes of waveguide in accordance with the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0025]** Hereinafter, a lighting apparatus using microwave in accordance with the present invention will be described with reference to accompanying drawings.

**[0026]** There can be a plurality of embodiments of a lighting apparatus using microwaves in accordance with the present invention, hereinafter the most preferable embodiment will be described.

**[0027]** Figure 2 is a longitudinal sectional view illustrating a lighting apparatus using microwaves in accordance with the present invention, and Figure 3 is a plan view illustrating the lighting apparatus of Figure 2 taken along the line of A-A.

**[0028]** The lighting apparatus using microwaves in accordance with the present invention includes a resonator 50 having a metal mesh structure and an opened lower portion, a waveguide 60 inserted into the opened portion of the resonator 50, placed at the internal area 53 of the resonator 50 having a ~~sphere~~-spherical structure and transmitting microwaves, and a casing 70 combined to the bottom portion 62 of the resonator 50 and the waveguide 60.

**[0029]** A plurality of outwardly extended flange portions 51, 61, 66, 71 are respectively formed at the resonator 50, waveguide 60 and casing 70 and adhered tightly by bolts 90.

**[0030]** The resonator 50 has a metal mesh structure constructed with a certain size of hole except the flange portion 51 so as to exclude microwaves and transmit light, and the bulb 80 emitting light by generating a plasma by the

microwaves transmitted through the waveguide 60 is placed at the center of the sphere shaped resonator 50.

**[0031]** The waveguide 60 has a ~~conic~~-conical shape having an opened bottom portion 62 and is constructed with a body portion 63 placed inside the resonator 50 and a cover portion 65 formed as a curved surface same as the ~~sphere~~ spherical shape of the resonator 50 and combined to the bottom portion 62 of the body portion 63.

**[0032]** At least one outlet 63a is formed at the inclined plane of the body portion 63 in order to transmit the microwaves transmitted from the magnetron 73 into ~~the~~ an internal area 53 of resonator 50.

**[0033]** Particularly, a concave portion 64 hollowed as a hemisphere shape is formed in order to make a place for the bulb 80 ~~place~~ at the vertex of the waveguide 60.

**[0034]** And, a reflecting mirror 85 is installed between the bulb 80 and the concave portion 64 in order to reflect light emitted from the bulb 80 intensively in the front.

**[0035]** Herein, a reflecting layer coated with materials having reflecting elements can be formed at the external surface of the concave portion 64 of the waveguide 60.

**[0036]** A rotation shaft 77 penetrating the waveguide 60 is connected to the bulb 80, and a bulb motor 78 rotating the bulb 80 by being connected to the end portion of the rotation shaft 77 is installed at the bottom surface of the waveguide 60.

**[0037]** The magnetron 73 is installed at the bottom surface 65 of the waveguide 60 inside the casing 70 and oscillates microwave inside the waveguide 60.

**[0038]** A high voltage generator 74 boosting AC current and supplying the boosted AC current to the magnetron 73 is installed at the internal side of the

casing 70, and a refrigerating fan 75 and a motor for the refrigerating fan 76 are installed at the lower portion of the casing 70 in order to refrigerate the magnetron 73 and the high voltage generator 74.

**[0039]** ~~In the meantime, as~~ As depicted in Figure 3, three slots 63a' lengthily (first slots) with lengths formed in the radius direction and three slots 63a" (second slots) with lengths ~~lengthily~~ other elements in Figure 3 are formed in the ~~circumference~~ circumferential direction are arranged with a certain distance therebetween the same as in Figure 2.

**[0040]** Figures 4A, 4B, and 4C are plan views of other embodiments illustrating shapes of waveguide in accordance with the present invention.

**[0041]** As depicted in Figure 4A, in another embodiment of the present invention, three slots ~~63'~~ 63a' ~~lengthily with lengths~~ formed in the radius direction are placed at 120° as the outlet 63a of the waveguide 60.

**[0042]** As depicted in Figure 4B, in still another embodiment of the present invention, two slots ~~63'~~ 63a' ~~lengthily with lengths~~ formed in the radius direction and one slot 63a" ~~lengthily with a length~~ formed in the circumference direction are placed at 120° as the outlet 63a of the waveguide 60.

**[0043]** As depicted in Figure 4C, in yet still another embodiment of the present invention, three slots ~~63'~~ 63a' ~~lengthily with lengths~~ formed in the radius direction and one slot 63a" ~~lengthily with a length~~ formed in the circumference direction are placed at 120° as the outlet 63a of the waveguide 60.

**[0044]** The operation of the lighting apparatus using microwaves in accordance with the present invention will be described.

**[0045]** When the magnetron 73 oscillates microwaves, the microwaves ~~is~~ are transmitted into the waveguide 60 and ~~is~~ are radiated inside the resonator through each outlet 63a.

**[0046]** Herein, the microwaves emitted inside the resonator 50 ~~performs~~perform a resonance motion inside the resonator 50, and ~~generates~~generate a plasma and an inherent spectrum by exciting the materials enclosed inside the bulb 80

**[0047]** Most of ~~lights~~light generated in the bulb 80 and reflected onto the reflecting mirror 85 ~~are~~is emitted in the front through the hole of the resonator 50, part of the light reflected onto the metal mesh of the resonator 50 is concentrated on the center C of the resonator 50, namely the bulb 80 placed at the focus of the sphere, and is reflected in the front through the reflecting mirror 85, accordingly loss of the light can be reduced.

**[0048]** The lighting apparatus using microwaves in accordance with the present invention is capable of improving a lighting efficiency and miniaturizing a lighting system by minimizing loss of light emitted from a bulb by placing the bulb at the center of a resonator having a ~~sphere~~spherical shape and installing a waveguide inside the resonator.

**[0049]** The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.